BEHAVIOR OF PATHOGENIC BACTERIA IN FERMENTED MILKS

BY

FERNE LOIS WILSON

B. S., Montana State College, 1939

M. S., University of Illinois, 1940

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN BACTERIOLOGY
IN THE GRADUATE SCHOOL OF THE UNIVERSITY
OF ILLINOIS, 1944

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degrees of acidity, as well as methods of study, it is difficult to compare results of various investigations.

Bacterial cultures used in this work were obtained from culture collections of the Departments of Bacteriology and Dairy Bacteriology, University of Illinois. *Eberthella typhosa, Salmonella paratyphi, Shigella paradysenteriae* Flexner, *Salmonella schottmülleri* and *Shigella dysenteriae* Shiga were previously sent from the University of Illinois College of Medicine; the first three had been obtained from the American Type Culture Collection. The lactic acid producing bacteria obtained from Dr. M. J. Prucha, formerly of the Department of Dairy Husbandry, were *Lactobacillus acidophilus* X, 4 and 12. Three cultures from a commercial product, Flav-o-lac Flakes, Dairy Laboratories, Philadelphia, Pennsylvania, were designated as "Acidophilus A", "Bulgarian B" and "Buttermilk" cultures. For differential media to demonstrate presence of pathogens in acid milk products MacConkey Agar was most satisfactory; Bismuth Sulfite Agar was also used for *Eberthella* and *Salmonella* tests, and SS Agar for *Shigella* cultures. Lactic acid producing bacteria were completely inhibited by these culture media.

Natural conditions occurring in preparation and storage of fermented milks were duplicated as much as possible in this investigation. During natural fermentation of milk, acids other than lactic are known to be present. It was decided to first compare action of pure lactic acid and mixtures of acids produced during natural fermentation. Lactic acid producing bacteria produced different amounts of acid in sterile skimmed milk. *Eberthella typhosa, Salmonella paratyphi, Salmonella schottmülleri, Shigella dysenteriae* and *Shigella paradysenteriae* Flexner were destroyed more rapidly when lactic acid was added to milk than when natural fermentation occurred. Results of such experiments must, therefore, be applied with caution to commercially prepared fermented milks.

It might be possible to infect milk before or during addition of lactic acid producing cultures or, following acid formation, when the product is bottled for commercial distribution. Experiments were performed to determine effect of time of possible

infection upon pathogens. The milk was treated much the same as it would be commercially, expect for artificial inoculation of pathogenic bacteria, that is, after addition of fermenting organisms, milk samples were incubated at 37°C. (98.6°F.) until coagulated, and then stored in a refrigerator. Greater longevity of pathogens was noted when acidity increased gradually than when they were inoculated into milk previously fermented. Variable resistance of organisms to germicidal agents should be considered when large numbers are inoculated. Many cells may have been destroyed, but a few highly resistant individuals may have survived and even multiplied. Slower increase in acidity permitted development of acid tolerant strains if they were present.

Commercial buttermilk has an acidity ranging from 0.6 to 0.95 per cent (pH 4.2 to 4.8). In naturally fermented milk it is not sufficient to destroy pathogens tested within a reasonable time. In fermented milk with acidity of 0.95 to 1.15 per cent (pH 3.9 to 4.2), pathogens survive from one to fourteen days; with acidity of 0.50 to 0.86 per cent (pH 4.3 to 5.0), pathogens persist from two to eight weeks.

Fermented milks should be made only from high grade milk, pasteurized or sterilized by approved methods. They should be handled as carefully as are all perishable dairy products. This is necessitated by the fact that there is wide variation in acidity and amount of contamination which might be acquired.

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Societies

American Association for the Advancement of Science
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